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| EXAMINER |
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BERNATZ, KEVIN M

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| ART UNIT | PAPER NUMBER |
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1773

DATE MAILED: 10/01/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/603,986

Applicant(s)

HASEGAWA ET AL.

Examiner

Kevin M Bernatz

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) 10-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-6,9 and 21-25 is/are rejected.
- 7) ☒ Claim(s) 7,8,26 and 27 is/are objected to.
- 8) ☒ Claim(s) 1-27 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 6/24/03 and 11/7/03.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

DETAILED ACTION

Response to Amendment

1. Preliminary amendments to the specification and claims 1, 2, 6, 8 – 10, 12, 18 and 20, and addition of claims 21 - 27, filed on June 24, 2003, have been entered in the above-identified application.

Examiner's Comments

2. The Examiner notes that the language regarding the second antiferromagnetic layers is not explicit that there are two *separate* antiferromagnetic elements and that a single antiferromagnetic layer disposed above the free layer would not read on the claimed invention. However, since applicants have claimed *layers*, and the specification is clear that there must be two distinct antiferromagnetic elements making up the second antiferromagnetic layers, the Examiner has interpreted the claimed limitations in this manner when evaluating the prior art. Applicants may want to consider amending the claim to recite "two second antiferromagnetic elements disposed ..." to better clarify the claimed invention.
3. Regarding the limitations "lower electrode" and "upper electrode", the Examiner notes that "lower" and "upper" are not germane to the determination of patentability, since merely changing the frame of reference when viewing the article will change which layer is the "upper" or "lower" layer. The only structural limitations imparted from such language is the relative location of the layers vis a vis the other claimed layers.

4. Regarding the language "insulating layers disposed on both end faces in a track width direction of the multilayered film", the Examiner notes that the above language does not require the insulating layers to extend along the *entire* end faces, but must merely contact the end face at some point. The Examiner does note that there must be at least 2 such layers, since applicants' have positively claimed "first insulating layers".

5. Regarding the limitation(s) "an upper electrode layer disposed over the second antiferromagnetic layers and the second free magnetic layer exposed to a space between the second antiferromagnetic layers in the track width direction" in claims 1 and 2, the Examiner has given the term(s) the broadest reasonable interpretation(s) consistent with the written description in applicants' specification as it would be interpreted by one of ordinary skill in the art. *In re Morris*, 127 F.3d 1048, 1054-55, 44 USPQ2d 1023, 1027 (Fed. Cir. 1997); *In re Donaldson Co., Inc.*, 16 F.3d 1190, 1192-95, 29 USPQ2d 1845, 1848-50 (Fed. Cir. 1994). See MPEP 2111. Specifically, the Examiner notes that the present language can be interpreted in two different ways, either

- "an upper electrode layer disposed over the second antiferromagnetic layers and the portion of the second free magnetic layer exposed to a space between the second antiferromagnetic layers in the track width direction"; or
- "an upper electrode layer disposed over the second antiferromagnetic layers and the second free magnetic layer and the upper electrode layer is exposed to a space between the second antiferromagnetic layers in the track width direction".

Both interpretations are supported by applicants' as-filed disclosure and since the present language is not precise, for purposes of evaluating the prior art the Examiner has allowed either interpretation.

6. Regarding the relative location of the ferromagnetic layer in claims 5 and 6, the Examiner notes that claim 5 is open to the ferromagnetic layer only existing between the second free magnetic layer and each of the two second antiferromagnetic elements, as well as extending between the two second antiferromagnetic elements. While claim 6 recites that the upper surface of the second free magnetic layer is exposed between the two second antiferromagnetic elements, the non-magnetic layer in claim 6 can reside either between the ferromagnetic layer elements (if only located under the two second antiferromagnetic elements), or above or below the ferromagnetic layer portion that is between the two second antiferromagnetic elements. The Examiner notes that applicants' specification appears to only disclose embodiments wherein the ferromagnetic layer and non-magnetic layer extend across the entire surface between the two second antiferromagnetic elements, as well as the region between them. Applicants should consider amending the language of claims 5 and 6 to better correspond to the disclosed invention.

Election/Restrictions

7. Applicant's election of Group I, claims 1 – 9 and 21 - 27 in the reply filed on June 15, 2004 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as

an election without traverse (MPEP § 818.03(a)). The requirement is still deemed proper and is therefore made FINAL.

Claim Objections

8. Claims 7, 8, 26 and 27 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim Rejections - 35 USC § 112

9. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

10. Claims 5, 6, 24 and 25 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a ferromagnetic layer and non-magnetic layer interposed between the two second antiferromagnetic elements, as well as between them, does not reasonably provide enablement for either or both layers to exist either just under the two second antiferromagnetic elements or just between the two second antiferromagnetic elements.. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make the invention commensurate in scope with these claims. This rejection can be overcome by amending claims 5 and 6 to positively recite that the ferromagnetic and non-magnetic layers are disposed on the second free magnetic layer in the space

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between the second antiferromagnetic elements in the track width direction as well as under the second antiferromagnetic elements.

Claim Rejections - 35 USC § 102

11. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

12. Claims 1, 3, 4, 9, 22 and 23 are rejected under 35 U.S.C. 102(a) and 102(e) as being anticipated by Redon et al. (U.S. Patent No. 6,469,879 B2).

13. Claims 1, 3, 4, 9, 22 and 23 are rejected under 35 U.S.C. 102(b) as being anticipated by Redon et al. (JP 2001-006127 A). See U.S. '879 B2, which is the U.S. equivalent of JP '127 A.

Regarding claim 1, Redon et al. disclose a magnetic sensing element (*Title*) comprising an electrode (*i.e. applicants' "lower electrode"*) layer (*Figure 2, elements 75/85*), a multilayer film comprising a first antiferromagnetic (AFM) layer (*element 50 and col. 7, lines 24 – 29*), a pinned magnetic layer (*element 40*), a nonmagnetic material layer (*element 30*), and a first free magnetic layer (*Figure 2, element 20 and Figure 3,*

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element 23) deposited in that order on the lower electrode layer, first insulating layers disposed on both end faces in a track width direction of the multilayered film (*elements 93 and 93*), a second free magnetic layer (*Figure 3, element 21*) disposed over the first insulating layers and the first free magnetic layer, second AFM layers (*Figure 2, elements 61 and 61 and col. 11, lines 3 – 6*) disposed on both side regions of the second free magnetic layer facing the first insulating layers in a thickness direction (*interface of elements 61 and 93*), and an electrode (i.e. applicants' "upper electrode") layer (*elements 71/81*) disposed over the second AFM layers (*elements 61*) and the second free magnetic layer (*element 21*) exposed to a space between the second AFM layers in the track width direction (*Figure 2, "plateau" between elements 61*).

Regarding claims 3 and 4, Redon et al. disclose a nonmagnetic layer (*Figure 3, element 22*) meeting applicants' claimed material limitations (*col. 7, lines 64 – 67*) interposed between the first and second free magnetic layers.

Regarding claims 9, 22 and 23, the Examiner notes that the language "functions as a ... shielding layer" is an intended use/functional limitation and is met by the disclosed structure since Redon et al. disclose that the combined layers 71/81 and 75/85 are electrode + shield (i.e. magnetic) layers. Since both layers are metallic, the Examiner deems that both layers would be capable of conducting electrons and meeting the claimed functional/intended use limitation.

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14. Claims 1 - 4, 9 and 21 - 23 are rejected under 35 U.S.C. 102(a) and 102(e) as being anticipated by Umetsu (U.S. Patent App. No. 2003/0030948 A1).

15. Claims 1 - 4, 9 and 21 - 23 are rejected under 35 U.S.C. 102(a) as being anticipated by Umetsu (JP 2003-0060264 A). See U.S. '948 A1, which is the U.S. equivalent of JP '264 A.

Regarding claim 1, Umetsu discloses a magnetic sensing element (*Title*) comprising an electrode (*i.e. applicants' "lower electrode"*) layer (*Figure 2, element 20*), a multilayer film comprising a first AFM layer (*element 23 and Paragraph 0134*), a pinned magnetic layer (*element 27*), a nonmagnetic material layer (*element 50*), and a first free magnetic layer (*element 32*) deposited in that order on the lower electrode layer, first insulating layers disposed on both end faces in a track width direction of the multilayered film (*elements 31 and 31*), a second free magnetic layer (*element 40*) disposed over the first insulating layers and the first free magnetic layer, second AFM layers (*elements 41 and 41 and Paragraph 0207*) disposed on both side regions of the second free magnetic layer facing the first insulating layers in a thickness direction (*Figure 2*), and an electrode (*i.e. applicants' "upper electrode"*) layer (*element 37*) disposed over the second AFM layers (*elements 41*) and the second free magnetic layer (*element 40*) exposed to a space between the second AFM layers in the track width direction (*Figure 2, "Tw" region 41a*).

Regarding claim 2, Umetsu discloses that optional protective layers (*i.e. applicants' "second insulating layers"*) can be located between the second AFM layers and the upper electrode layer (*Figure 1, element 36 and Paragraph 0161*).

Regarding claims 3 and 4, Umetsu discloses a nonmagnetic layer (*Figure 2, element 33*) meeting applicants' claimed material limitations (*Paragraph 0152*) interposed between the first and second free magnetic layers.

Regarding claims 9 and 21 - 23, Umetsu discloses the claimed intended use/functional limitation (*Paragraphs 0131 and 0162*).

16. Claims 1, 3, 9 and 22 are rejected under 35 U.S.C. 102(a) and 102(e) as being anticipated by Beach (U.S. Patent App. No. 0131215 A1).

Regarding claim 1, Beach discloses a magnetic sensing element (*Title*) comprising a lead (*i.e. applicants' "lower electrode"*) layer (*Figure 4b, element 401*), a multilayer film comprising a first AFM layer (*element 402 and Paragraphs 0041 and 0042*), a pinned magnetic layer (*element 411*), a nonmagnetic material layer (*element 406*), and a first free magnetic layer (*element 407*) deposited in that order on the lower electrode layer, first insulating layers disposed on both end faces in a track width direction of the multilayered film (*elements 410 and 410*), a second free magnetic layer (*element 413*) disposed over the first insulating layers and the first free magnetic layer, second AFM layers (*elements 414 and 414 and Paragraphs 0041 and 0042*) disposed on both side regions of the second free magnetic layer facing the first insulating layers in a thickness direction (*Figure 4b*), and a lead (*i.e. applicants' "upper electrode"*) layer (*element 415*) disposed over the second AFM layers (*elements 414*) and the second free magnetic layer (*element 413*) exposed to a space between the second AFM layers in the track width direction (*area noted by element 439*).

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Regarding claim 3, Beach discloses a nonmagnetic layer (*Figure 4b, element 412*) interposed between the first and second free magnetic layers.

Regarding claims 9 and 22, Beach discloses the claimed intended use/functional limitation (*Paragraph 0029*).

Claim Rejections - 35 USC § 103

17. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

18. Claims 4 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Beach as applied above, and further in view of Hoshiya et al. (U.S. Patent App. No. 2003/0206384 A1).

Beach is relied upon as described above.

Beach fails to disclose the material for the non-magnetic layer, element 412.

However, Hoshiya et al. teach that for synthetic free, or "AP pinned structure" as disclosed by Beach, the non-magnetic material is preferably selected from materials meeting applicants' claimed material limitations in order to insure the proper anti-parallel magnetization directions and exchange coupling forces (*Figure 22 and Paragraphs 0088 and 0099*).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Beach to use a material meeting

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applicants' claimed material limitations as taught by Hoshiya et al. since such a material can insure the proper anti-parallel magnetization directions and exchange coupling forces.

19. Claims 1, 3 – 6, 9 and 22 – 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hoshiya et al. ('384 A1) in view of Beach ('215 A1).

Regarding claim 1, Hoshiya et al. disclose a magnetic sensing element (*Title*) comprising a conductive gap/shield (*i.e. applicants' "lower electrode"*) layer (*Figure 22, elements 35 and 711*), a multilayer film comprising a first AFM layer (*element 11 and Paragraph 0093*), a pinned magnetic layer (*element 15*), a nonmagnetic material layer (*element 121*), and a first free magnetic layer (*element 133*) deposited in that order on the lower electrode layer, first insulating layers disposed on both end faces in a track width direction of the multilayered film (*elements 73 and 73*), a second free magnetic layer (*either element 134 or 412*) disposed over the first insulating layers and the first free magnetic layer, a second AFM layer (*element 413 and Paragraph 0093*) disposed on both side regions of the second free magnetic layer facing the first insulating layers in a thickness direction (*Figure 22*), and a conductive gap/shield (*i.e. applicants' "upper electrode"*) layer (*elements 36 and 721*) disposed over the second AFM layer (*element 413*) and the second free magnetic layer (*either element 134 or 412*).

Hoshiya et al. fail to disclose the second AFM layer being split into two AFM elements, one on each side regions of the second free magnetic layer.

However, Beach teaches that the use of two AFM layers meeting applicants' claimed structural limitations above the free magnetic layer serves to bias the free magnetic layer as well as to control the active region of the free magnetic layer (*Paragraphs 0006, 0010, 0029, and 0038*).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Hoshiya et al. to use a second AFM layer comprising two AFM elements meeting applicants' claimed structural limitations as taught by Beach since such a structure serves to bias the free magnetic layer as well as to control the active region of the free magnetic layer.

Regarding claims 3 and 4, Hoshiya et al. disclose a nonmagnetic layer (*Figure 22, element 411*) meeting applicants' claimed material limitations (*Paragraph 0094*) interposed between the first (*element 133*) and second (*element 412*) free magnetic layers.

Regarding claim 5, Hoshiya et al. disclose a ferromagnetic layer (*element 412*) interposed between the second free magnetic layer (*element 134*) and the second antiferromagnetic layer (*element 413*).

Regarding claim 6, Hoshiya et al. disclose a nonmagnetic layer (*element 411*) disposed on the second free magnetic layer (*element 134*) meeting applicants' claimed structural limitations.

Regarding claims 9 and 22 - 25, Beach discloses that instead of using separate lead/electrodes and shields, one of ordinary skill in the art could use a magnetic "electrode" meeting the claimed intended use/functional limitation (*Paragraph 0029*),

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which would save on deposition costs by reducing the complexity of the sensor forming method.

Conclusion

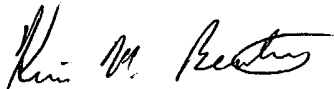
20. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Shimazawa et al. (U.S. Patent No. 6,451,215 B1) teach substantially identical subject matter as in Redon et al. above. No rejection has been made under Shimazawa et al., since it is deemed that should applicants' overcome the Redon et al. rejections of record, they will almost necessarily overcome any rejection that would have been made using the Shimazawa et al. reference.

21. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin M Bernatz whose telephone number is (571) 272-1505. The examiner can normally be reached on M-F, 9:00 AM - 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Deborah Jones can be reached on (571) 272-1535. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Kevin M. Bernatz, PhD.
Primary Examiner

September 28, 2004